

# A study of serum malondialdehyde levels in patients of acute coronary syndrome with type-2 dm and type-2 dm patients without acute coronary syndrome

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ABSTRACT

Diabetes mellitus is a metabolic disorder characterized by hyperglycemia due to impaired insulin response or insulin secretion. Malondialdehyde (MDA) is an end product of lipid peroxidation, noted to be significantly increased in type 2 diabetes which cause atherosclerotic lesions. The aim of this study is to find serum Malondialdehyde (MDA) levels in patients of acute coronary syndrome with type 2 diabetes mellitus and type 2 diabetes mellitus patients without Acute Coronary Syndrome (ACS). A total of 212 patients with Type 2 Diabetes Mellitus (T2 DM) from the Saveetha Medical College and Hospital's General Medicine department were enrolled in the study. There were 106 individuals with Type 2 DM without acute coronary syndrome and another 106 patients with Type 2 DM with acute coronary syndrome. Duration of diabetes mellitus, total cholesterol, elevated TAG, elevated Low Density Lipoprotein (LDL), low High Density Lipoprotein (HDL) were significantly associated with the development of acute coronary syndrome among diabetic patients. The mean Serum MDA among the participants in the T2DM with Acute coronary syndrome was  $3.90 \pm 0.44$  mg/dl while among those in the T2DM without acute coronary syndrome was  $1.98 \pm 0.45$  mg/dl. With a p value of less than 0.05, According to recent research, there is a negative correlation between MDA-LDL levels and HDL-C levels and a positive correlation with triglyceride and LDL-C levels. The traditional Cardiovascular disease risk factors including diabetes, hypertension, hyperlipidemia, and cigarette smoking are strongly linked with higher MDA levels.

**Keywords:** malondialdehyde, acute coronary syndrome, diabetes, hyperglycemia

## INTRODUCTION

Diabetes mellitus is a metabolic disease marked by elevated blood sugar levels brought on by insufficient insulin secretion or responsiveness [1]. Cellular alterations and an elevated risk of atherosclerotic cardiovascular disease may result from certain metabolic diseases [2]. Lipid peroxidation produces Malondialdehyde (MDA), which has been found to be markedly elevated in type 2 diabetes, a condition that results in atherosclerotic plaques [3]. One of the main causes of mortality and morbidity in people with type 2 diabetes mellitus is cardiovascular disease. Elevated LDL cholesterol levels are the primary cause of atherosclerosis, while there are several factors that contribute to its progression. Three more factors that contribute to atherosclerosis include obesity, decreased glucose tolerance, and smoking [4]. When macrophages infiltrate the arterial intima during atherosclerosis, thick plaques form, narrowing the artery and leading to cardiovascular disease [5].

Malondialdehyde (MDA) interacts reversibly or irreversibly with the proteins and phospholipids resulting in harmful effects. Malondialdehyde causes stiffness of collagen fibers in cardiovascular system and also results in increased resistant to remodeling [6]. Malondialdehyde is used as a putative of lipid oxidation in arterial lesions. Recently research showed that both oxidized Low Density Lipoprotein (ox-LDL) and Malondialdehyde seen in the atherosclerotic plaque [7]. However, there is still a debate on the relation between the MDA levels and type 2 diabetes duration [8, 9].

One of the main products of lipid peroxidation and the main source of oxidized low-density lipoprotein is Malondialdehyde Modified Low Density Lipoprotein (MDA-LDL). Similar to oxidized LDL, MDA-LDL has been demonstrated in multiple studies to be a significant marker for assessing the degree of cardiovascular disease. In patients with type-2 diabetes who have experienced a previous myocardial infarction or stable angina pectoris after PCI, MDA-LDL levels are also predictive of stent restenosis.

Various studies conducted over the past three decades have shown a correlation between elevated MDA levels and CVD. There is proof that traditional CVD risk factors including diabetes, hypertension, hyperlipidemia, and cigarette smoking are strongly linked with higher MDA levels.

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## MATERIAL AND METHOD

This cross-sectional study was conducted at the General Medicine department of Saveetha Medical College and Hospital. A total of 212 patients diagnosed with Type 2 Diabetes Mellitus (T2DM) were enrolled. They were divided into two groups: 106 patients with T2DM without Acute Coronary Syndrome (ACS) and 106 patients with T2DM with ACS.

### Inclusion criteria

Patients aged 18 years or older with confirmed diagnosis of T2DM were eligible for inclusion.

### Exclusion criteria

Patients with history of endocrine diseases, alcohol consumption, smoking, antioxidant supplement usage, hepatic diseases, and severe renal impairment were excluded from the study.

### Data collection

Complete medical history and clinical examination were conducted for all patients.

### Laboratory investigations included

Blood pressure measurement, Fasting blood glucose level assessment, Glycated Hemoglobin (HbA1C) measurement, Total cholesterol level determination, Serum triglyceride level

assessment, High-Density Lipoprotein (HDL) cholesterol measurement, Low-Density Lipoprotein (LDL) cholesterol measurement, Serum creatinine level determination, Measurement of serum Malondialdehyde (MDA) levels.

### Statistical analysis

Descriptive statistics were used to summarize patient characteristics. Student's t-test or Mann-Whitney U test was employed to compare continuous variables between groups, while chi-square test was used for categorical variables. A p-value < 0.05 was considered statistically significant. Ethical Considerations: The study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the institutional review board.

## RESULTS

### Comparison between serum MDA level and ACS

The mean Serum MDA among the participants in the T2DM with ACS was 3.90 mg/dl ± 0.44 mg/dl while among those in the T2DM without ACS was 1.98 ± 0.45 mg/dl. With a p-value of less than 0.05, it was discovered that the mean serum MDA was significantly higher in the T2DM with ACS group than the T2DM without ACS group (Tables 1 and 2 and Figure 1).

Variable	Acute Coronary Syndrome (Mean (SD))			
	Yes(n=106)	No(n=106)	t Test Statistic	p-Value
Serum MDA (nmol/ml)	3.9(0.44)	2(0.5)	31.3	0.000

MDA level	NSTEMI(n=37)	STEMI(n=44)	UA(n=25)	T2DM without ACS (n=106)
Normal (1.6 nmol/ml and below)	0	0	0	17(16%)
High (>1.6 nmol/ml)	37(34.9%)	44(41.5%)	25(23.6%)	89 (84%)

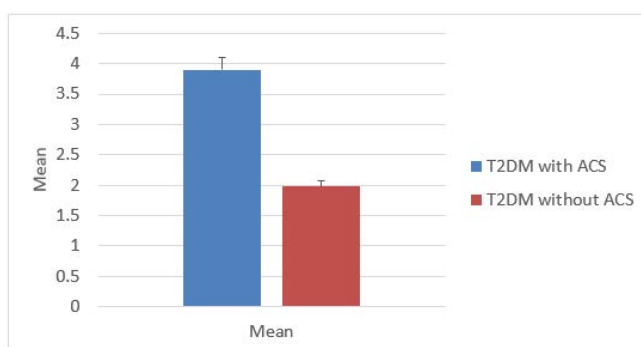


Fig. 1. Bar chart showing comparison of mean Serum MDA in patients of T2DM with ACS and T2DM without ACS

All the T2DM patients with ACS had high MDA level (100%) MDA levels (Figure 2 and Table 3). whereas 84 % of the T2DM patients without ACS had high

Variable	Acute Coronary Syndrome			F statistic	p-Value
	NSTEMI(n=37)	STEMI(n=44)	UA(n=25)		
Serum MDA level (Mean (SD))	3.8086 (0.15)	4.2718(0.3)	3.3916(0.3)	495	0.000

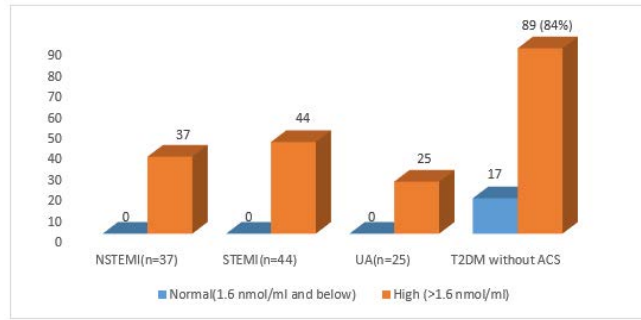


Fig. 2. Bar chart showing comparison of MDA levels and acute coronary syndrome types

Significant difference exists in the mean MDA levels and it is more higher in more severe forms (Table 4).

Tab. 4. Bivariate analysis: Risk factors of acute coronary syndrome in diabetic patients

	Category	Yes (n=106)	No (n=106)	Odds ratio (95% CI)	p-Value
Age (Yrs)	59 years and above	52 (50.5%)	51 (49.5%)	1.04 (0.6 to 1.8)	0.89
	<59 years	54 (49.5%)	55 (50.5%)		
Sex	Female	53 (50.5%)	52 (49.5%)	1.04 (0.6 to 1.8)	0.89
	Male	53 (49.5%)	54 (50.5%)		
Duration of Diabetes Mellitus (yrs)	>8 years	96 (89.7%)	11 (10.3%)	82.9 (33.6 to 204.4)	<0.00001
	8 years and below	10 (9.5%)	95(90.5%)		
Hypertension	Yes	21(41.7%)	14 (53.3%)	0.94 (0.5 to 1.8)	0.9
	No	85 (48%)	92(52%)		
Glycemic Control	Poor (HbA1C 7% and above)	106 (55.2%)	86 (44.8%)	-	<0.00001
	Good (HbA1C <7%)	0	20 (100%)		
Total Cholesterol (mg/dl)	Elevated (200 mg/dl and above)	25 (69.4%)	11 (30.6%)	2.7 (1.2 to 5.7)	0.01
	Normal(<200mg/dl)	81 (46%)	95 (54%)		
Serum Triglyceride (mg/dl)	Elevated (150 mg/dl and above)	24 (66.7%)	12 (33.3%)	2.3 (1 to 4.9)	0.03
	Normal (<150mg/dl)	82 (46.6%)	94 (53.4%)		
HDL (mg/dl)	Low<45 mg/dl)	25 (69.4%)	11 (30.6%)	2.7 (1.2 to 5.7)	0.01
	Normal (45 mg/dl and above)	81 (46%)	95 (54%)		
LDL (mg/dl)	Elevated (100 mg/dl and above)	25 (69.4%)	11(30.6%)	2.7 (1.2 to 5.7)	0.01
	Normal (<100mg/dl)	81 (46%)	95 (54%)		
Serum MDA (nmol/ml)	High (>1.6)	0	17 (100%)	-	<0.00001
	Normal (1.6 and below)	106 (57.3%)	89 (45.6%)		

Duration of diabetes Mellitus (more than 8 years), Total cholesterol, elevated TAG, Elevated LDL and low HDL had 82 times, 2.7 times, 2.3 times, 2.7 times and 2.7 times more odds of developing acute coronary syndrome among diabetic patients respectively. It is statistically significant (p<0.05).

## DISCUSSION

Malondialdehyde is an important risk factor for cardiovascular diseases. Mc Murray conducted a study to found the concentration of MDA in patients with type 2 Diabetes Mellitus-2 (DM2) and patients with coronary disease and noted an increased level of malondialdehyde in coronary artery patients. M Rábago-Velasco et al. found increased plasma MDA and considered as a biochemical marker for cardiovascular disease. The author suggests MDA levels greater than 62.7 mgm/dl is an important risk factor for

myocardial infarction [10]. According to recent research, there is a negative correlation between MDA-LDL levels and HDL-C levels and a positive correlation with triglyceride and LDL-C levels [11].

In our present study, we noted that there mean serum MDA was significantly higher in the T2DM with ACS group than the T2DM without ACS group. The lipid profile of the patients showed triglyceride and HDL-C in poor control group was higher than in good control group.

In another study noted that there is a significant relationship between HbA1c and dyslipidemia and serum triglyceride. The triglyceride increased levels produced reduced lipoprotein lipase activity in hyperglycemic patients [12].

In our investigation, we identified a substantial positive connec-

tion between blood MDA levels and lipid profile markers (TC, TG, and LDL) in the diabetic group, which was consistent with findings by Tangvarasittichai et al. and Hamad et al. (2009) [13, 14].

Urinary MDA levels and glycemic control were revealed to be related to type 2 diabetes mellitus using multivariate analysis. Urinary malonaldehyde levels and glycemic control in our T2DM patients are linked with HDL-C, triglyceride, and FBS levels.

According to our research, the development of acute coronary syndrome in diabetic patients was substantially correlated with total cholesterol, high TAG, elevated LDL, and low HDL. Acute coronary syndrome was more likely to develop in diabetic individuals with duration of diabetes mellitus (more than 8 years), total cholesterol, increased TAG, elevated LDL, and low HDL, respectively, by 82 times, 2.7 times, 2.3 times, 2.7 times, and 2.7 times. At  $p < 0.05$ , it is statistically significant.

## CONCLUSION

Serum MDA levels are increased in both groups but the elevation was much higher in T2DM with ACS group which reveals the importance of serum Malondialdehyde as an oxidative stress marker which starts to increase early during the course of T2DM. The study indicates serum MDA level as a good predictor of Acute coronary syndrome. Duration of diabetes Mellitus, Total cholesterol, elevated TAG, Elevated LDL, low HDL were significantly associated with the development of acute coronary syndrome among diabetic patients. Thus our study shows that estimation of serum Malondialdehyde levels helps in early detection of atherosclerosis in Type 2 Diabetes Mellitus (DM) patients and can help to reduce the extent of damage.

In our study, MDA is more elevated in patients with ACS than in those with type 2 diabetes, either with or without ACS, compared to early stages of the disease, severe or uncontrolled diabetes, or diabetes with comorbidities. Future cardiac events may be significantly predicted by serum MDA-LDL levels.

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